Labor Rates

Labor rates identify the cost to the firm of consuming a particular resource—an hour of labor. Labor rate calculations begin with a basic hourly wage or salary. Next, costs directly caused by direct labor but not captured in the basic wage are added. These other direct labor costs include:

- break time and/or tour length costs,
- paid absence costs,
- special payments such as team awards and recognition,
- payroll taxes, pension costs, benefit costs,
- support assets, including capital costs associated with support assets,
- other direct costs such as travel and training, and clerical support and supervision.

Labor rates are developed at the proper level of detail to provide accurate costs for specific activities. First, SBC looks at specific groups of function codes (which designate a specific job function) or activity codes (which designate a specific job activity). These function/activity codes are part of SBC's functional accounting system used to report expenses company-wide. For example, the group 43XX is the group of all wages and expenses charged to function codes or activity codes that begin with "43". Specifically, "43" represents Network and Installation functions and activities.

Within the specific group, SBC develops labor rates by Market Zone (for management employees) or Wage Category (for non-management employees). The Market Zones and Wage Categories are specific job classifications that determine how much the company pays for a particular job.

The Labor rates in this study begin with an average wage per hour from payroll records. Planned increases are added to make the average wage forward-looking. SBC derives relationships of expenses to wages (or expenses to hours worked) to develop labor factors or loadings that are applied to basic wages to produce total hourly labor cost.

Attachment 3

Switching Information Cost Analysis Tool

Tool Documentation

Version 3.0

Notice of Disclaimer

SBC reserves the right to revise this document for any reason, including but not limited to, conformity with standards promulgated by various agencies, utilization of advances in the state of the technical arts, or reflection of changes in the design of any equipment, techniques, or procedures described or referred to herein.

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Switching Information Cost Analysis Tool

Table of Contents

1.0 Introduction

Section 1.0 provides an overview of the Switching Information Cost Analysis Tool (SICAT). The purpose of SICAT and its overall organization and output are described. Then, the costing methodology is briefly covered.

For those wanting more background on switching and switch costs, Section 2 discusses the public switched telephone network, the switch architecture and the nature of switch costs, especially today's vendor pricing of switching systems. Sections 3 and 4 provide detailed descriptions of SICAT input data and the bills of costs used to develop output.

Electronic and paper copies of SICAT are contained in Appendix B.

1.1 Purpose of SICAT

SICAT measures the forward-looking costs of switching systems in SBC telecommunications networks. These include material costs, vendor engineering and labor charges, and other charges for the design, construction and installation of switches and additions to switch capacity. These are referred to as vendor engineered, furnished and installed (EF&I) costs.[1]

A telecommunications switch is an electronic device connecting subscriber telephone lines to the lines of other telephone subscribers in a local network or to trunks providing interoffice communications with other switches and telephone subscribers. The interoffice communications can be within the local exchange area or for long distance calling. The switch also supervises calls for the duration of calls, provides calling features and performs administrative functions.

End office switches terminate local subscriber telephone lines, and *tandem* switches are used for the interconnection of interoffice trunks in the local and long distance networks. (See Section 2.1 for a further description of switching in the telecommunications network.)

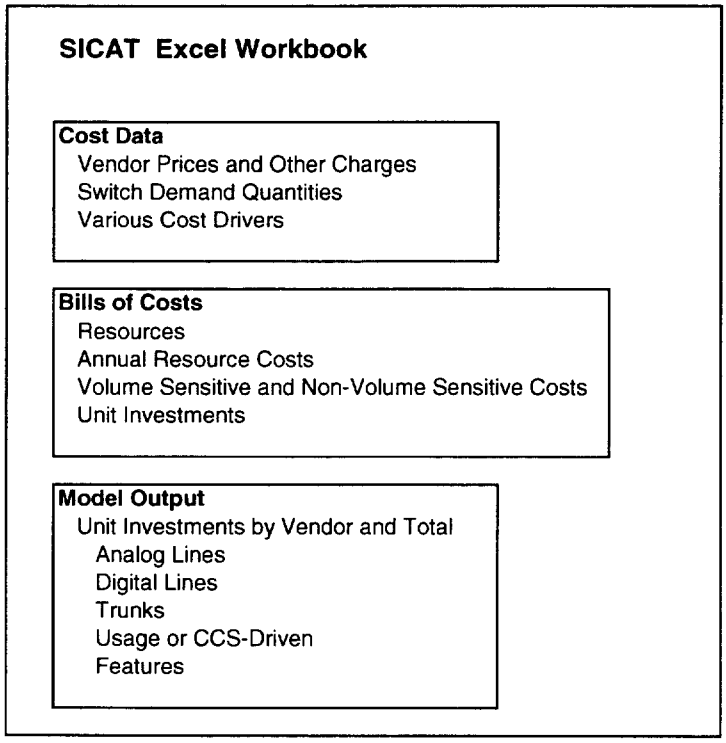
SICAT measures switch costs in terms of *EF&I costs per unit of demand*; i.e., switch lines, trunks, etc. Its output is used in subsequent cost studies of wholesale and retail products, which require switch functions (line termination, call processing, features, etc.).

[1] Throughout the documentation the terms cost and investment are used interchangeably. Unless specified otherwise, the terms mean the engineered, furnished and installed costs of switching equipment. Costs do not mean the recurring capital costs (depreciation, cost of money and income taxes) associated with capital invested in switches or operating expenses (maintenance, property taxes, etc.).

1.2 SICAT Overview and Output

SICAT is a Microsoft Excel® workbook containing spreadsheets with user-supplied cost data, "bills of costs" in which switching costs are calculated, and an output report containing switch costs per line, trunk, etc. (See Figure 1.1.) As mentioned above, this cost information is used in SBC cost studies for wholesale and retail products that require end office and tandem switches for terminating lines, processing calls and providing calling features. Unit investments are used in cost studies for unbundled network elements (UNEs) provided to competitive local exchange carriers (CLECs) and for retail services, such as residential and business local telephone service.

Figure 1.1



SICAT input consists of three types of cost and other data:

Vendor prices and other charges. SBC operating companies acquire switching systems from three vendors – Vendor A Technologies, Vendor B Networks and Vendor C. The vendor's switching systems are referred to as the AESS, BESS, and CESS respectively. SICAT contains spreadsheets with current vendor prices used to calculate switch costs. It also captures the costs of network upgrades and

capitalized software necessary to maintain the call processing capability of switching systems in the future.

Switch Demand Quantities. Switching systems are sized to accommodate customer demand for telephone lines and trunks. SICAT determines costs over a five-year planning period based on forecasts of switch replacements, growth in existing switches and the placement of new switches.

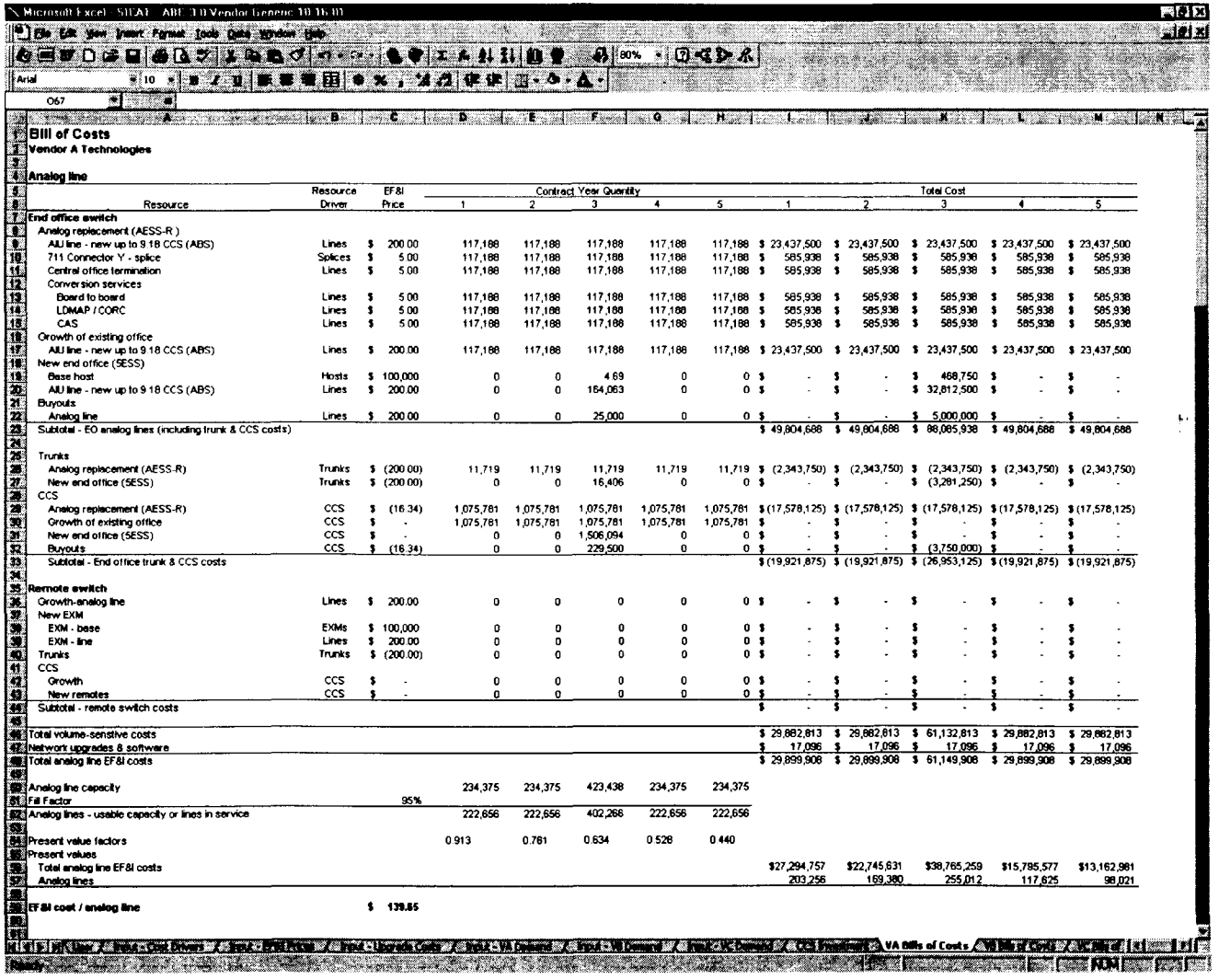
Various cost drivers. There are sizing relationships, such as the numbers of telephone subscriber lines per trunk or the call usage per line, that influence switch sizing and costs. These values are used to compute trunk and switch usage capacity requirements and costs.

An important feature of SICAT is its use of "bills of costs." The bills of costs are similar to a bill a consumer or business receives for purchased goods or services. It summarizes vendor contract items, prices, quantities, and total costs each year of the planning period. Figure 1.2 illustrates a bill of cost for the Vendor A analog line.

Costs are calculated on separate bills for lines, trunks, call usage, and features. Bills of costs are provided for each vendor. The bills also capture the costs of major hardware and software upgrades during the planning period necessary to keep switching systems up-to-date. Total costs for a switch component (lines, trunks, etc.) are tallied and divided by the demand volume to compute unit investments.

Unit investments are then summarized for switch components and vendors on the Output spreadsheet, where state-specific technology weighting factors are applied to compute average switch investments. This is shown in Figure 1.3.

Figure 1.2

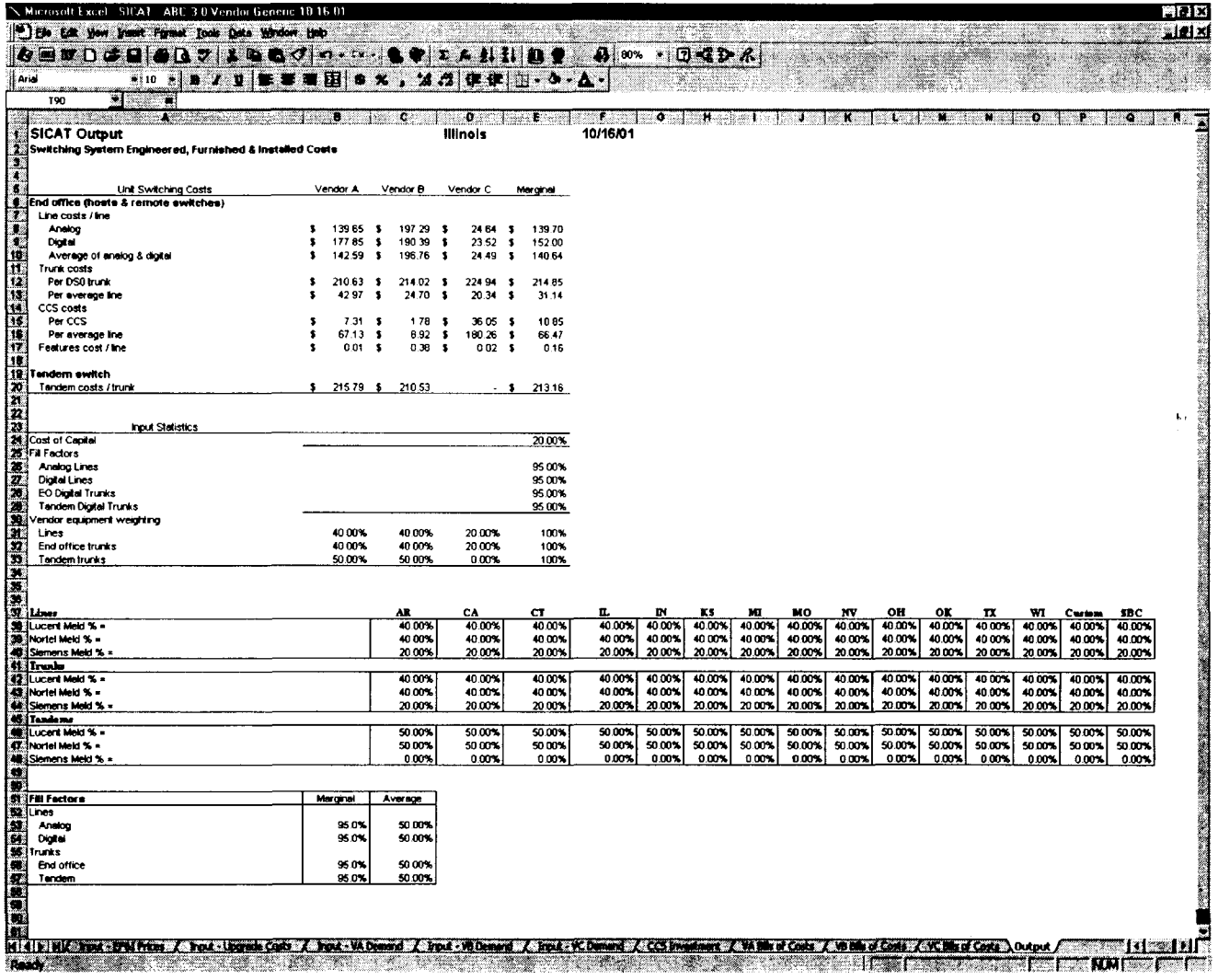


Bill of Costs
Vendor A Technologies

Analog line

Resource	Resource Driver	EF&I Price	Contract Year Quantity 1	2	3	4	5	Total Cost 1	2	3	4	5
End office switch												
Analog replacement (AESS-R)												
AIU line - new up to 9 18 CCS (ABS)	Lines	$ 200.00	117,188	117,188	117,188	117,188	117,188	$ 23,437,500	$ 23,437,500	$ 23,437,500	$ 23,437,500	$ 23,437,500
711 Connector Y - splice	Splices	$ 5.00	117,188	117,188	117,188	117,188	117,188	$ 585,938	$ 585,938	$ 585,938	$ 585,938	$ 585,938
Central office termination	Lines	$ 5.00	117,188	117,188	117,188	117,188	117,188	$ 585,938	$ 585,938	$ 585,938	$ 585,938	$ 585,938
Conversion services												
Board to board	Lines	$ 5.00	117,188	117,188	117,188	117,188	117,188	$ 585,938	$ 585,938	$ 585,938	$ 585,938	$ 585,938
LDMAP / CORC	Lines	$ 5.00	117,188	117,188	117,188	117,188	117,188	$ 585,938	$ 585,938	$ 585,938	$ 585,938	$ 585,938
CAS	Lines	$ 5.00	117,188	117,188	117,188	117,188	117,188	$ 585,938	$ 585,938	$ 585,938	$ 585,938	$ 585,938
Growth of existing office												
AIU line - new up to 9 18 CCS (ABS)	Lines	$ 200.00	117,188	117,188	117,188	117,188	117,188	$ 23,437,500	$ 23,437,500	$ 23,437,500	$ 23,437,500	$ 23,437,500
New end office (5ESS)												
Base host	Hosts	$ 100,000	0	0	4.69	0	0	$ -	$ -	$ 468,750	$ -	$ -
AIU line - new up to 9 18 CCS (ABS)	Lines	$ 200.00	0	0	164,063	0	0	$ -	$ -	$ 32,812,500	$ -	$ -
Buyouts												
Analog line	Lines	$ 200.00	0	0	25,000	0	0	$ -	$ -	$ 5,000,000	$ -	$ -
Subtotal - EO analog lines (including trunk & CCS costs)								$ 49,804,688	$ 49,804,688	$ 88,085,938	$ 49,804,688	$ 49,804,688
Trunks												
Analog replacement (AESS-R)	Trunks	$ (200.00)	11,719	11,719	11,719	11,719	11,719	$ (2,343,750)	$ (2,343,750)	$ (2,343,750)	$ (2,343,750)	$ (2,343,750)
New end office (5ESS)	Trunks	$ (200.00)	0	0	16,406	0	0	$ -	$ -	$ (3,281,250)	$ -	$ -
CCS												
Analog replacement (AESS-R)	CCS	$ (16.34)	1,075,781	1,075,781	1,075,781	1,075,781	1,075,781	$ (17,578,125)	$ (17,578,125)	$ (17,578,125)	$ (17,578,125)	$ (17,578,125)
Growth of existing office	CCS	$ -	1,075,781	1,075,781	1,075,781	1,075,781	1,075,781	$ -	$ -	$ -	$ -	$ -
New end office (5ESS)	CCS	$ -	0	0	1,506,094	0	0	$ -	$ -	$ -	$ -	$ -
Buyouts	CCS	$ (16.34)	0	0	229,500	0	0	$ -	$ -	$ (3,750,000)	$ -	$ -
Subtotal - End office trunk & CCS costs								$ (19,921,875)	$ (19,921,875)	$ (26,953,125)	$ (19,921,875)	$ (19,921,875)
Remote switch												
Growth-analog line	Lines	$ 200.00	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -
New EXM												
EXM - base	EXMs	$ 100,000	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -
EXM - line	Lines	$ 200.00	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -
Trunks	Trunks	$ (200.00)	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -
CCS												
Growth	CCS	$ -	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -
New remotes	CCS	$ -	0	0	0	0	0	$ -	$ -	$ -	$ -	$ -
Subtotal - remote switch costs								$ -	$ -	$ -	$ -	$ -
Total volume-senstive costs								$ 29,882,813	$ 29,882,813	$ 61,132,813	$ 29,882,813	$ 29,882,813
Network upgrades & software								$ 17,096	$ 17,096	$ 17,096	$ 17,096	$ 17,096
Total analog line EF&I costs								$ 29,899,908	$ 29,899,908	$ 61,149,908	$ 29,899,908	$ 29,899,908
Analog line capacity			234,375	234,375	423,438	234,375	234,375					
Fill Factor		95%										
Analog lines - usable capacity or lines in service			222,656	222,656	402,266	222,656	222,656					
Present value factors			0.913	0.781	0.634	0.528	0.440					
Present values												
Total analog line EF&I costs								$27,294,757	$22,745,631	$38,765,259	$15,785,577	$13,162,981
Analog lines								203,256	169,380	255,012	117,625	98,021
EF&I cost / analog line		**$ 139.85**										

Figure 1.3



Microsoft Excel - SICAT - ABC 3.0 Vendor Generic 10 16 01

SICAT Output — **Illinois** — **10/16/01**

Switching System Engineered, Furnished & Installed Costs

Unit Switching Costs	Vendor A	Vendor B	Vendor C	Marginal
End office (hosts & remote switches)				
Line costs / line				
Analog	$ 139.65	$ 197.29	$ 24.64	$ 139.70
Digital	$ 177.85	$ 190.39	$ 23.52	$ 152.00
Average of analog & digital	$ 142.59	$ 196.76	$ 24.49	$ 140.64
Trunk costs				
Per DS0 trunk	$ 210.63	$ 214.02	$ 224.94	$ 214.85
Per average line	$ 42.97	$ 24.70	$ 20.34	$ 31.14
CCS costs				
Per CCS	$ 7.31	$ 1.78	$ 36.05	$ 10.85
Per average line	$ 67.13	$ 8.92	$ 180.26	$ 66.47
Features cost / line	$ 0.01	$ 0.38	$ 0.02	$ 0.16
Tandem switch				
Tandem costs / trunk	$ 215.79	$ 210.53	$ -	$ 213.16

Input Statistics				
Cost of Capital				20.00%
Fill Factors				
Analog Lines				95.00%
Digital Lines				95.00%
EO Digital Trunks				95.00%
Tandem Digital Trunks				95.00%
Vendor equipment weighting				
Lines	40.00%	40.00%	20.00%	100%
End office trunks	40.00%	40.00%	20.00%	100%
Tandem trunks	50.00%	50.00%	0.00%	100%

Lines	AR	CA	CT	IL	IN	KS	MI	MO	NV	OH	OK	TX	WI	Custom	SBC
Lucent Meld % =	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%
Nortel Meld % =	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%
Siemens Meld % =	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Trunks															
Lucent Meld % =	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%
Nortel Meld % =	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%	40.00%
Siemens Meld % =	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Tandems															
Lucent Meld % =	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%
Nortel Meld % =	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%
Siemens Meld % =	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Fill Factors	Marginal	Average
Lines		
Analog	95.0%	50.00%
Digital	95.0%	50.00%
Trunks		
End office	95.0%	50.00%
Tandem	95.0%	50.00%

Input - SPM Prices / Input - Upgrade Costs / Input - VA Demand / Input - VB Demand / Input - VC Demand / CCS Investment / VA Bills of Costs / VB Bills of Costs / VC Bills of Costs / Output

Ready NUM

Additional costs of construction, such as telephone company engineering and labor costs, power plant and miscellaneous and sundry expenditures are added to the output of SICAT to determine total switching investments for use in subsequent product cost studies.

1.3 General Description of Methodology

EF&I costs per line, trunk, etc. represent the *incremental cost* SBC will incur in the future for replacements of existing analog switching systems, growth in existing digital switching systems and construction of entirely new switch entities. *SICAT does not measure historical or embedded switch costs.*

The methods used to compute costs include the following:

> *Use of current resource costs.* Costs are based on current contracts with Vendor A, Vendor B and Vendor C. The prices contained in the input data are obtained directly from the contracts. Since contract items and price levels apply for the foreseeable future, prices are not inflated or deflated over the planning period.
>
> *Volume-sensitive costs reflect total switch additions.* SICAT determines quantities of contract items SBC will purchase to satisfy digital switching system replacements, growth and construction each year of a five-year planning period. The quantities are applied to contract prices to compute total annual vendor purchases.
>
> *Non-volume sensitive costs for switching hardware and software upgrades are separately identified and apportioned.* SBC will make annual investments for switch hardware and software upgrades. The investments are shared by existing switch capacity and future capacity additions. SICAT separately identifies hardware and software upgrade investments and attributes them to existing capacity and future capacity additions.
>
> *Unit investments reflect either engineering fill or average utilization.* SICAT allows the user to specify the fill factor used in calculating per-unit costs. Engineering fill factors are used to measure *marginal* investments, and average utilization factors are used to compute *average* investments, which include spare capacity costs.[2]

Section 2.3 provides additional background on the costing concepts underlying these methods.

[2] Marginal unit investments do not include the cost of spare capacity. They include the cost of resource capacity for a small amount of defective equipment, administrative use, etc. Switch engineering fill factors used to compute marginal investments usually are 95% or greater.

2.0 Background on Switching System Costs

This section provides a basic understanding of the public telecommunications network and the function of switching systems. It also provides background on the typical switch architecture. This information is important in understanding the categories of switch costs – lines, trunks, usage and features – and the differences between end office, tandem and remote switches.

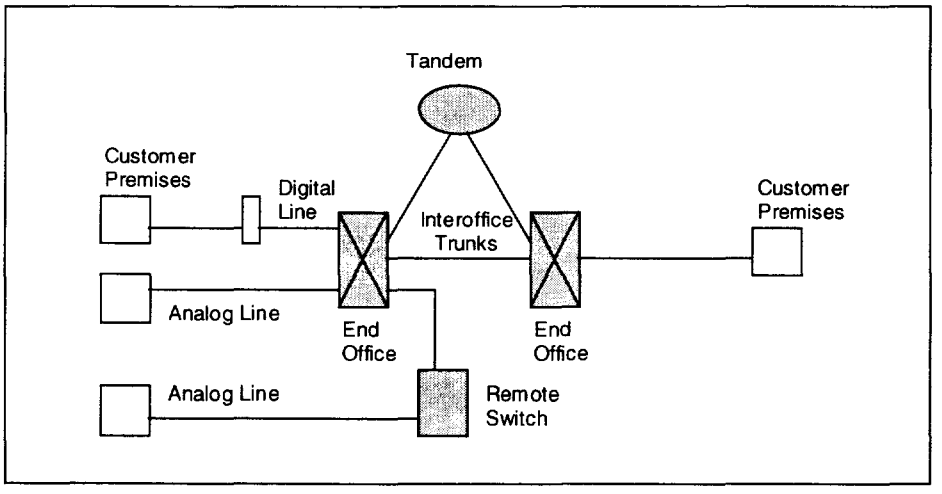
The cost structure of switches also is covered. For many years, vendors individually priced switching system equipment components – line equipment, trunk equipment, processors of different types, memory equipment, etc. Switch costs were a function of the demand for many equipment items, and complex engineering rules were needed to determine equipment quantities and costs. Today, vendors offer much simpler pricing arrangements. It is important to understand the current vendor pricing structure.

There are several important cost concepts underlying the methodology in SICAT, such as the method used to distinguish line-driven and usage-driven costs and the effect of utilization on unit investments. These concepts are discussed.

2.1 Switching in Telecommunications Networks

Figure 2.1 is a simplified diagram of the public telecommunications network.

Figure 2.1



Telephone equipment at a customer's premises is connected to copper cables, which provide a communications path from the telephone equipment to a local telephone

company *end office*. The communications path may be over a pair of copper wires running from the customer's premises to the end office, or the copper pair may terminate at an intermediate terminal where a digital communications channel is provided using electronic equipment and fiber cables to the end office.

At the end office, the copper cable pair is connected to *line equipment* on the end office switch. The line equipment provides direct current to the customer's telephone line, detects when the customer goes "off hook" to make a call, provides dial-tone and performs other functions. Line equipment typically is dedicated to each customer line, and is often referred to as *non-traffic sensitive* plant, since the amount of customer calling does not affect the amount of line equipment required.

If the customer is provided access to the end office via a digital line, the digital transmission may be converted back to an analog signal, or the digital channels may be directly terminated on the switch. Copper access lines and digital lines reconverted to analog signals are referred to as *analog lines*, whereas digital channels terminating directly on the switch are *digital lines*. Each requires different line termination equipment with different switch costs.

When a customer makes a phone call, the end office switch performs several functions. It receives digits of the telephone number being called, communicates with the signaling network to establish the call, and provides a call path through the switch to another telephone line or to an interoffice trunk (if the called party is served by another end office). The capacity requirements for switch equipment providing these functions is sensitive to the number of call attempts and call duration during the peak period of use.[3]

In some vendor contracts, prices vary depending upon peak period usage per access line. Usage or call duration can be measured in *minutes of use* per line. In the telephone industry usage is measured in increments of 100 call seconds (centi call seconds or CCS). In SICAT, line and CCS-driven costs are distinguished.

The other key switching equipment category is trunk equipment. The equipment capacity required to connect switches to interoffice trunks depends on the amount of incoming and outgoing interoffice traffic. SICAT separately identifies switch costs for trunk equipment.

In addition to switch hardware, SBC purchases software and pays right-to-use fees for generic operating systems and features. These fees also are part of switch investment.[4] Customer lines also may terminate on *remote* switches located closer to customers than end offices. Remotes perform some end office functions. They are connected to host,

[3] Usage sensitive switching equipment is sized to handle traffic during the Average Busy Season (ABS) busy hour (BH). Usage is measured during this period, and switching equipment is sized to provide a satisfactory grade of service during the period.

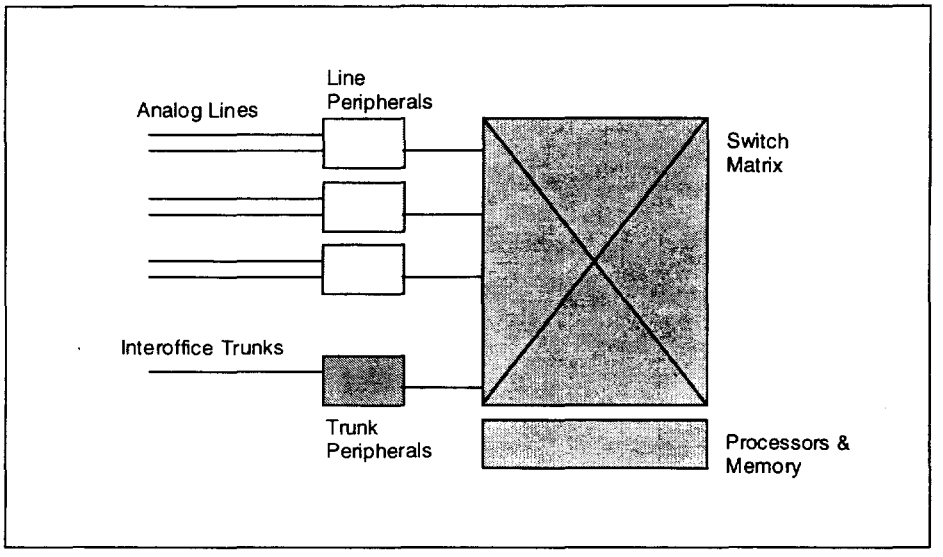
[4] Software and right-to-use fees can either be expensed or capitalized for accounting purposes. SICAT only considers those fees that are capitalized.

end offices via trunks. Vendors charge different prices for lines terminating on remote switches.

Tandem switches are used to connect interoffice trunks transporting traffic among end offices and between the SBC network and those of other carriers. SICAT separately measures the tandem switch costs and develops an investment per tandem trunk.

Figure 2.2 illustrates the architecture of a typical end office switch and shows the equipment categories for which costs are determined by SICAT.

Figure 2.2



End office switching systems are essentially large computers. Line and trunk peripherals are similar to ports on a computer. They terminate access lines and interoffice trunks. Switch processors perform many functions, including call set-up, providing features and administering the switch. The switch matrix provides call paths among lines and trunks for the duration of calls. Both switch processors and the switch matrix are usage sensitive in that they are engineered to handle call processing during peak periods of use.

As with a personal computer, the switch requires software to perform these functions. Some software is for the generic operating system of the switch, and others provide features, such as Call Waiting, Caller ID, etc. SICAT determines the portion of switch investment attributable to each of these resources – lines, trunks, usage-driven plant and features.

It is important to note that SICAT determines only the costs of digital electronic switching systems, rather than analog electronic or electromechanical switching. Analog electronic and electromechanical switches are no longer constructed in SBC

telecommunications networks. SICAT also does not determine the costs of Common Channel Signaling Systems and Asynchronous Transfer Mode (ATM) switches that also are considered digital electronic switching in the Federal Communication Commission's (FCC) Part 32 Account 2212. These are specialized switches used for signaling and data communications.

2.2 Switch Costs

Switching systems are one of several types of telephone plant. Others include cable and wire facilities, transmission equipment, etc. According to the Federal Communications Commission's Uniform System of Accounts, telephone plant investments include all costs of constructing plant – vendor materials and supplies, telco labor and engineering costs, transportation, taxes, etc.[5]

SICAT captures a portion of these construction costs, specifically the vendor EF&I cost. These represent the total charges from the switch manufacturer for materials, vendor engineering and installation labor. SICAT unit investments must be augmented with the other costs of construction. This is done using digital switching *investment loading factors* developed specifically for this purpose. Figure 2.1 illustrates the calculation of the total investment per analog line, beginning with the output of SICAT and applying the various investment loadings for the other switch construction costs.

[5] See FCC Part 32.1500 (c) for a description of telephone plant construction costs.

Table 2.1

Digital Switching Investment / Analog Line	
SICAT EF&I investment / analog line	$85.00
Material to EF&I ratio	85%
Material cost	$72.25
Sales tax rate	9%
Sales tax	$6.50
EF&I investment incl. sales tax	$91.50
Telco engineering loading	8%
Telco labor loading	8%
Miscellaneous & sundry loading	3%
Total installed cost	$ 108.89
Power equipment loading	0%
Total investment / analog line	$109.38

Prior to 1998, vendor EF&I charges for switching systems were based on purchased quantities of various switching system components, such as access interface units, analog line packs, integrated digital carrier units, analog trunk circuits, etc. Quantities for each component were determined based upon engineering rules specifying the capacity required to satisfy demand for analog and digital lines, peak period usage per line and other factors. Elaborate tools, such as Telcordia Technologies' Switching Cost Information System (SCIS), were necessary to reflect these engineering rules and to calculate switch costs based upon component pricing.

Beginning in 1998, the SBC operating companies negotiated simplified vendor contract arrangements. Rather than charging for switching systems based on switch components, charges now are based on aggregate measures of switch capacity requirements, such as analog and digital lines, trunks etc. SICAT develops switch costs based on the new vendor contracts and pricing. Figure 3.2 in Section 3 show the price structure for SBC's three switch suppliers.

Today, SBC determines the capacity of lines required for switch replacements, growth in existing switches and new switch construction. Vendor EF&I charges then are based on the line quantities and prices. Line prices differ for replacement and new switches and growth additions. Depending on the vendor, line prices also may vary depending upon the usage per line.

There also are prices for what are called buyout lines. In the past, vendors sometimes provisioned line capacity in existing switches and did not charge for the capacity until it

went into service. The buyout line price is the vendor charge for this growth line capacity.

There are other contract prices besides the line prices, such as prices for new remote switch lines, end office and tandem trunk prices, and base host prices, when new end office and remote switches are purchased. In addition to the contract prices, there also are annual costs for hardware and software upgrades.

2.3 Important Cost Concepts

This section provides additional background on cost concepts related to volume-sensitive and non-volume sensitive costs, fill factors and the identification of trunk and usage-related switch costs.

2.3.1 Volume-Sensitive and Non-Volume Sensitive Costs

The majority of vendor charges for switches vary with the volume of lines and trunks. Only hardware and software upgrade costs tend to be insensitive to volume. SICAT treats upgrade costs as shared non-volume sensitive costs and assigns the costs to total lines in service, consisting of existing lines in service and future line additions. Then, the portion of upgrade costs attributed to future line additions is assigned to lines, trunks, usage and features. Unit investments, therefore, reflect volume sensitive costs and a portion of future non-volume sensitive upgrade costs.

For example, suppose hardware and software upgrades to be paid to one of the switch vendors over the five-year planning period total $250 million. Also assume the existing lines in service for this vendor's switching system total 20 million, and that the present value of line additions over the planning period is 3 million. SICAT assigns 3/(20+3) of the $250 millions to line additions. Then, assume approximately 50% of switch costs are attributable to line equipment. Hardware and software upgrade costs of $16.3 million are assigned to line additions. The average cost per line in the example is $5.43, which is added to the volume sensitive cost per line.

2.3.2 Fill Factors

Telephone plant is provisioned with adequate capacity to serve immediate needs and to provide capacity for growth. At some point, capacity is effectively exhausted, and additional capacity must be placed. The difference between plant capacity and in-service demand represents spare capacity.

SICAT expresses capacity utilization in terms of fill factors. SICAT requires fill factors for lines, trunks, and features. Generally speaking, there are two values for the fill factor.

Average utilization. This is the ratio of capacity in service to total capacity. Average utilization can be estimated at the present (current average utilization) or over the planning period (forward-looking, average utilization). For many types of plant, the current and forward-looking average utilization are effectively the same, because utilization for network elements tends to reach a stable value as some elements gradually reach higher utilization levels, while new network elements are brought on-line.

Engineering fill. This represents the expected level of utilization when network elements, such as switch line or trunk peripherals, are exhausted, and additional capacity must be added. Engineering fill is seldom, if ever, 100%, because a portion of plant capacity will be unusable due to damage or defects. Often a portion of plant capacity is used to administer the network. And, sufficient spare must be retained to allow time for additional capacity to be constructed, once the decision is made to expand capacity.

Engineering fill for line equipment normally is in the range of 95 – 97%. This means for every 100 lines of capacity, three to five lines are set aside for administrative and testing purposes, and to provide temporary spare when capacity exhausts and additional lines must be placed.

In developing unit investments, SICAT applies either the average utilization factor or engineering fill factor to total switch capacity. If average utilization is used, the result is the average quantity in-service. When total switch costs are divided by this quantity, the result is the average incremental cost, including spare capacity costs. If engineering fill is applied to total switch capacity, the result is the quantity of usable capacity, and the unit investment is the marginal investment.

2.3.3 Identification of CCS and Trunk Costs

When an existing switching system is replaced or an entirely new switch is constructed, vendors charge line prices covering the costs of lines, trunks and usage-related equipment. There are no separate prices for lines, trunks and usage. When growth additions are made to existing switches, separate prices apply for lines and trunks, but not usage. Consequently, it is necessary to impute costs for trunks and usage inherent in the replacement and new line prices. In addition, usage costs must be imputed for growth and buyout line prices.

In the case of trunks, the approach is straightforward. The vendor contract price for growth additions of trunks can be used as the trunk cost and the cost removed from replacement and new line prices. This allows separate line and trunk costs to be measured. For example, the Vendor A replacement price for an analog line, splicing for 0% of lines and various conversion services total $0.00 per line. The price per digital

trunk is $0.00, and one trunk is required for every five lines. Therefore, the implicit trunk cost per line included in the replacement line price is $0.00 ($0.00 / 0). This amount is subtracted from the $0.00 line price to remove the cost of trunks.

For usage, the incremental cost per CCS must be calculated. The Vendor A contract provides three line prices depending upon the CCS per line. The incremental cost per CCS is calculated as the difference in line prices divided by the difference in usage between the prices for a basic line and the line with the next higher level of usage. The Vendor A end office CCS cost per replacement line is computed as follows:

$$Cost/CCS = (\$0.00 - \$0.00) \div (12.24 - 9.18) = \$0.00$$

where,

$0.00 = price per AIU line engineered at 12.24 CCS
$0.00 = price per AIU line engineered at 9.18 CCS

The cost per CCS is multiplied times the amount of CCS included in the line price to compute the CCS cost per line ($0.00 X 9.18). This amount is subtracted from the line price to remove the usage cost. In the previous example, the $0.00 line price is divided among the following costs: $0.00 trunk cost, $0.00 CCS cost and $0.00 line cost.

3.0 SICAT Input and Output

This section describes input data required by SICAT and the cost information provided. Input data consist of various cost drivers, vendor switch prices, network upgrade and software costs, and demand forecasts. Section 3.1 describes these data in detail. Cost information provided by SICAT includes switching investments per line, trunk and CCS of usage. Feature software investments per line also are provided. Section 3.2 describes SICAT output and its use.

3.1 Input Data

SICAT input data are contained in a series of six spreadsheets at the beginning of the workbook. The spreadsheets are organized to collect data of a particular type. For example, vendor prices are contained in the Input – EF&I Prices spreadsheet, and demand forecasts are provided in the Input – Demand spreadsheets.

Input data are the same for all SBC states, with the exception of technology weighting factors. These are percentages of lines and trunks in-service in a state used to weight vendor switch investments to compute average investments. Other cost data, such as vendor prices and engineering rules, are common to all states.

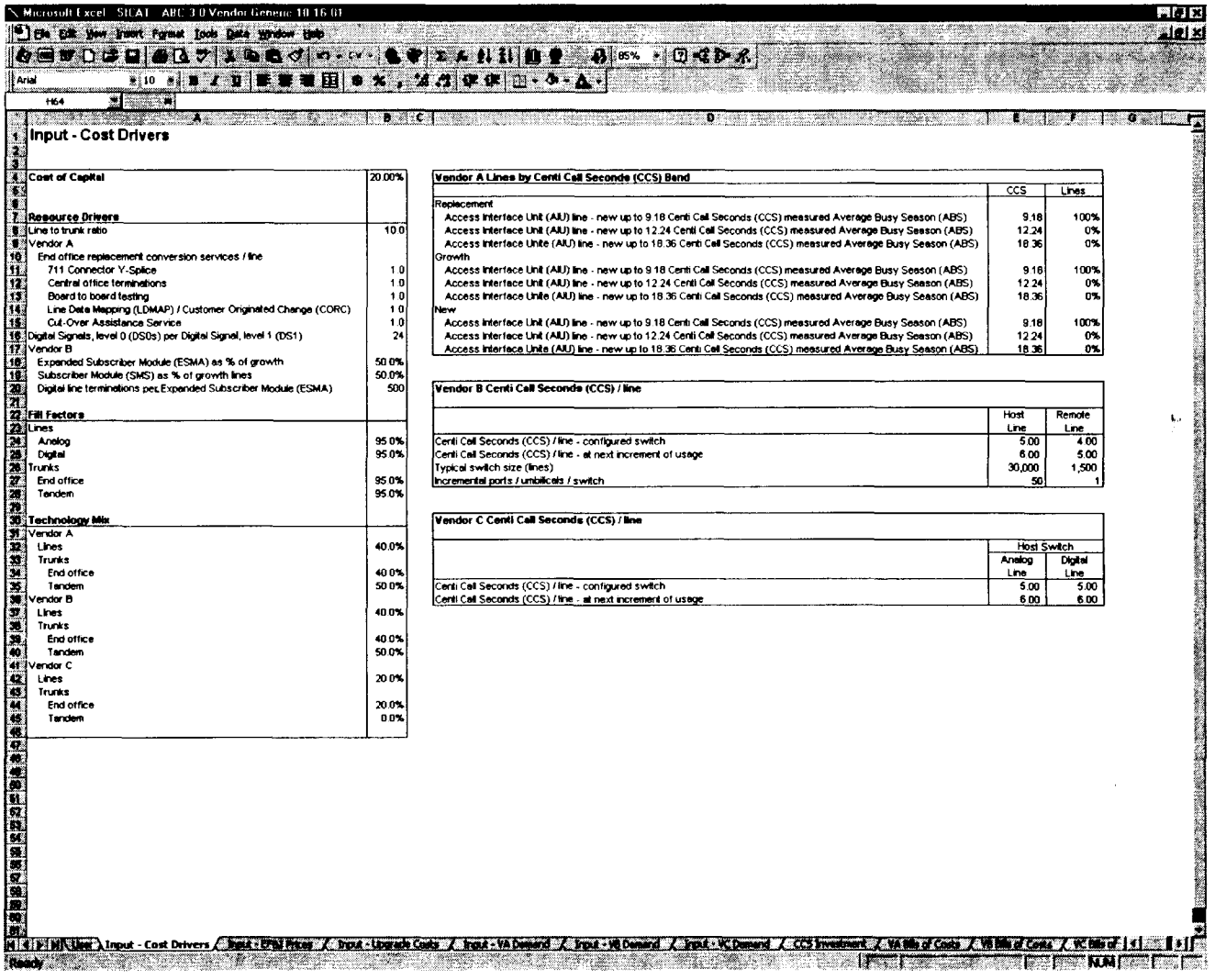
Input data are obtained from several sources, such as vendor contracts, the procurement organization of SBC Services and SBC Network Planning and Engineering. Once data have been gathered and entered in the input spreadsheets, the data remain constant until significant changes occur in the vendor contracts. Users can perform sensitivity analyses of SICAT output by modifying input data.

Cells in the input spreadsheets requiring user-supplied information are shaded light yellow.

3.1.1 Input - Cost Drivers

The *Input - Cost Drivers* spreadsheet contains a variety of data referred to as "cost drivers." These are numerical values or factors used in the SICAT bills of costs for various calculations. For example, the cost of capital is used in computing present values. There are other factors used to compute annual demand for switch components based on forecasts of line additions. Figure 3.1 is a copy of the Input – Cost Drivers spreadsheet.

Figure 3.1



Microsoft Excel - SICAT - ABC 3.0 Vendor Generic 10.16.01

Input - Cost Drivers

Cost of Capital	20.00%
Resource Drivers	
Line to trunk ratio	10.0
Vendor A	
End office replacement conversion services / line	
711 Connector Y-Splice	1.0
Central office terminations	1.0
Board to board testing	1.0
Line Data Mapping (LDMAP) / Customer Originated Change (CORC)	1.0
Cut-Over Assistance Service	1.0
Digital Signals, level 0 (DS0s) per Digital Signal, level 1 (DS1)	24
Vendor B	
Expanded Subscriber Module (ESMA) as % of growth	50.0%
Subscriber Module (SMS) as % of growth lines	50.0%
Digital line terminations per Expanded Subscriber Module (ESMA)	500
Fill Factors	
Lines	
Analog	95.0%
Digital	95.0%
Trunks	
End office	95.0%
Tandem	95.0%
Technology Mix	
Vendor A	
Lines	40.0%
Trunks	
End office	40.0%
Tandem	50.0%
Vendor B	
Lines	40.0%
Trunks	
End office	40.0%
Tandem	50.0%
Vendor C	
Lines	20.0%
Trunks	
End office	20.0%
Tandem	0.0%

Vendor A Lines by Centi Call Seconds (CCS) Band

	CCS	Lines
Replacement		
Access Interface Unit (AIU) line - new up to 9.18 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	9.18	100%
Access Interface Unit (AIU) line - new up to 12.24 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	12.24	0%
Access Interface Units (AIU) line - new up to 18.36 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	18.36	0%
Growth		
Access Interface Unit (AIU) line - new up to 9.18 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	9.18	100%
Access Interface Unit (AIU) line - new up to 12.24 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	12.24	0%
Access Interface Units (AIU) line - new up to 18.36 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	18.36	0%
New		
Access Interface Unit (AIU) line - new up to 9.18 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	9.18	100%
Access Interface Unit (AIU) line - new up to 12.24 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	12.24	0%
Access Interface Units (AIU) line - new up to 18.36 Centi Call Seconds (CCS) measured Average Busy Season (ABS)	18.36	0%

Vendor B Centi Call Seconds (CCS) / line

	Host Line	Remote Line
Centi Call Seconds (CCS) / line - configured switch	5.00	4.00
Centi Call Seconds (CCS) / line - at next increment of usage	6.00	5.00
Typical switch size (lines)	30,000	1,500
Incremental ports / umbilicals / switch	50	1

Vendor C Centi Call Seconds (CCS) / line

	Host Switch	
	Analog Line	Digital Line
Centi Call Seconds (CCS) / line - configured switch	5.00	5.00
Centi Call Seconds (CCS) / line - at next increment of usage	6.00	6.00

Input - Cost Drivers | Input - EPMI Prices | Input - Upgrade Costs | Input - VA Demand | Input - VB Demand | Input - VC Demand | CCS Investment | VA Bills of Costs | VB Bills of Costs | VC Bills of

Ready NUM

The *cost of capital* is used as the discount rate for present value calculations. The value used is the weighted average of SBC's forward-looking cost of equity and interest on debt based on the mix of equity and debt capital anticipated in the future. The current cost of capital is 0.00%.

The cost of capital is followed by six factors specific to Vendor A end office switches. These factors are used in the bills of costs to compute the volume of various replacement and conversion services performed by Vendor A when an existing switching system is replaced with a new Vendor A switch.

A *711 Connector Y-Splice* is a connector used to splice a replacement switch to the cabling on line and trunk termination frames attached to the existing switch being replaced. In the example shown in Figure 3.1, approximately 0% of lines installed on replacement switches require the Y-splice. This factor is used to compute the quantity of splices purchased each year of the planning period.

The *CO-Termination Per Line* is a charge for vendor labor to install the 711 connector Y-splice and to perform associated switch cut-over wiring.

Boards to Board Conversion Services provide for testing between the existing and replacement switches before service is converted to the replacement switch. Line translations, which are call processing instructions contained in the switching system, are tested to assure the replacement switch is correctly matching customer lines with appropriate telephone numbers.

Line Data Mapping (LDMAP) and Customer Originated Change (CORC) Conversion Services are for entering call processing information in the replacement switch and for transferring to the replacement switch information containing customer-requested changes in service previously stored in the existing switch.

Cut-Over Assistance Service (CAS) is for Vendor A to electronically retrieve information to be converted from the existing switch, translating the information to a usable format for the new switch, and returning the information to SBC for uploading to the replacement switch.

Each of these services are priced by Vendor A on a per line basis. The factors represent the percentage of lines to which the charges apply. Since the services apply to all lines, the factors are set at 1.0.

The next two cost drivers, Expanded Subscriber Module (ESMA) and Subscriber Carrier Module (SMS) as % of growth lines, are used in calculating Vendor B digital line costs. Vendor B switches provide digital lines using one of two arrangements. An ESMA is hardware added to a switch that increases the capacity of digital lines that can be terminated on the switch. ESMA equipment increases the number of digital links from

20 to 48 DS-1 ports. ESMAs are capable of terminating 1,920 digital lines. SMS equipment also increases the number of digital lines that can be terminated on a switch to 24 DS-1 ports. The factors provided in the input data are used to determine the mix of the two arrangements and the weighting given to the cost of each. The values should total to 100%.

The *line to trunk ratio* is a key cost driver. This represents the average number of analog and digital lines per interoffice trunk.[6] In Figure 3.1, the line to trunk ratio is 0.0, which indicates there are five lines per trunk. Five lines can share one trunk, because not all lines will be making calls at the same time and not all calls require transport to other switching systems. The line to trunk ratio is used to compute the number of interoffice trunks given demand for analog and digital lines on replacement and new switches.[7] The line to trunk ratio is obtained from the vendor contracts.

Another important cost driver is the ratio of *DS0s per DS1.* Some switch components, such as digital trunk units and carrier terminations for digital lines, transmit or receive traffic at the DS1 level (1.566 million bits per second). They are capable of handling multiple voice grade channels or DS0s. The DS0s per DS1 ratio is used to calculate the number of these components required to handle demand for lines and trunks.

The ratio typically is set at 24:1, indicating that one digital trunk unit is required for every 24 interoffice trunks, or one digital carrier termination unit is required for every 24 digital lines. The ratio can be set at a lower value to allow for spare capacity to meet future demand, testing, maintenance and administrative requirements.

Fill factors are required for analog and digital lines and end office and tandem trunks. They represent either the engineering fill for line and trunk equipment or the expected average utilization of this equipment. SICAT users have the option of using engineering fills or average utilization depending on whether marginal or average switch investments are to be measured.

Fill factors are mid-contract period estimates of capacity utilization provided by SBC Network Planning and Engineering. Section 2.3.2 describes fill factors and their use in calculating switch costs. Also, see Section 4.1.1 for a description of the use of the factors in cost calculations.

The *vendor technology mix* represents the percentages of total lines, end office trunks, and tandem trunks provided by the three vendors in a particular state. The figures are used to weight vendor switch investments to determine statewide averages.

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[6] An interoffice trunk is a voice grade channel connecting one switch to another. The trunk has the capacity to transport traffic equivalent to a single voice conversation, or 64,000 bits per second. This is referred to as DS0 level transmission. Trunks are provided over digital transmission facilities capable of simultaneously transmitting many DS0 channels. A DS1 transmission facility has the nominal capacity of 24 DS0 channels or trunks. A DS3 facility has the capacity of 672 trunks. OC3 has up to 2,016 trunks. Actual trunk capacity and utilization depend upon the engineering design of trunk groups.

[7] Trunks for growth in existing switches are forecast separately. The line to trunk ratio for growth additions differs somewhat from the 0.0 line to trunk ratio for switch replacements and new switches.

This spreadsheet also contains information used to measure CCS investment; i.e., switch EF&I cost attributable to usage.[8] For Vendor A switches, prices for lines (Access Interface Units) are provided at three possible usage levels – a basic level of up to 9.18 CCS per line, a second level of 12.24 CCS and the highest level of 18.36 CCS. Usage is measured during peak periods of switch utilization (the Average Busy Season (ABS) busy hour (BH)). The percentages of lines to be served at each level of usage are required input and are subsequently used in the CCS Investment spreadsheet.

For Vendor B switches, the CCS per line for a switch configured for a basic level of usage and the CCS per line for usage at the next, higher increment are required. These figures are required for both host and remote switches. In Figure 3.1, CCS values are shown for analog switches. Values for digital lines are the same as analog lines because it is assumed a digital line would not utilize more of the switch to process a call than an analog line.

In addition to the CCS per line for basic and higher usage levels, two other Vendor B cost drivers are required. The incremental ports per umbilical is the additional capacity required by a switch of approximately twenty-two thousand analog lines to satisfy the usage requirements at the higher usage level.[9] These data are used in the CCS Investment spreadsheet to calculate the Vendor B investment per CCS.

The Vendor C CCS data are similar to those of Vendor B. The engineered CCS per line for a basic host switch and for a switch engineered for a higher level of calling are required. Different values may be used for analog and digital lines, although the example shown in Figure 3.1 uses the same values for the two line types.

3.1.2 Input-EF&I Prices

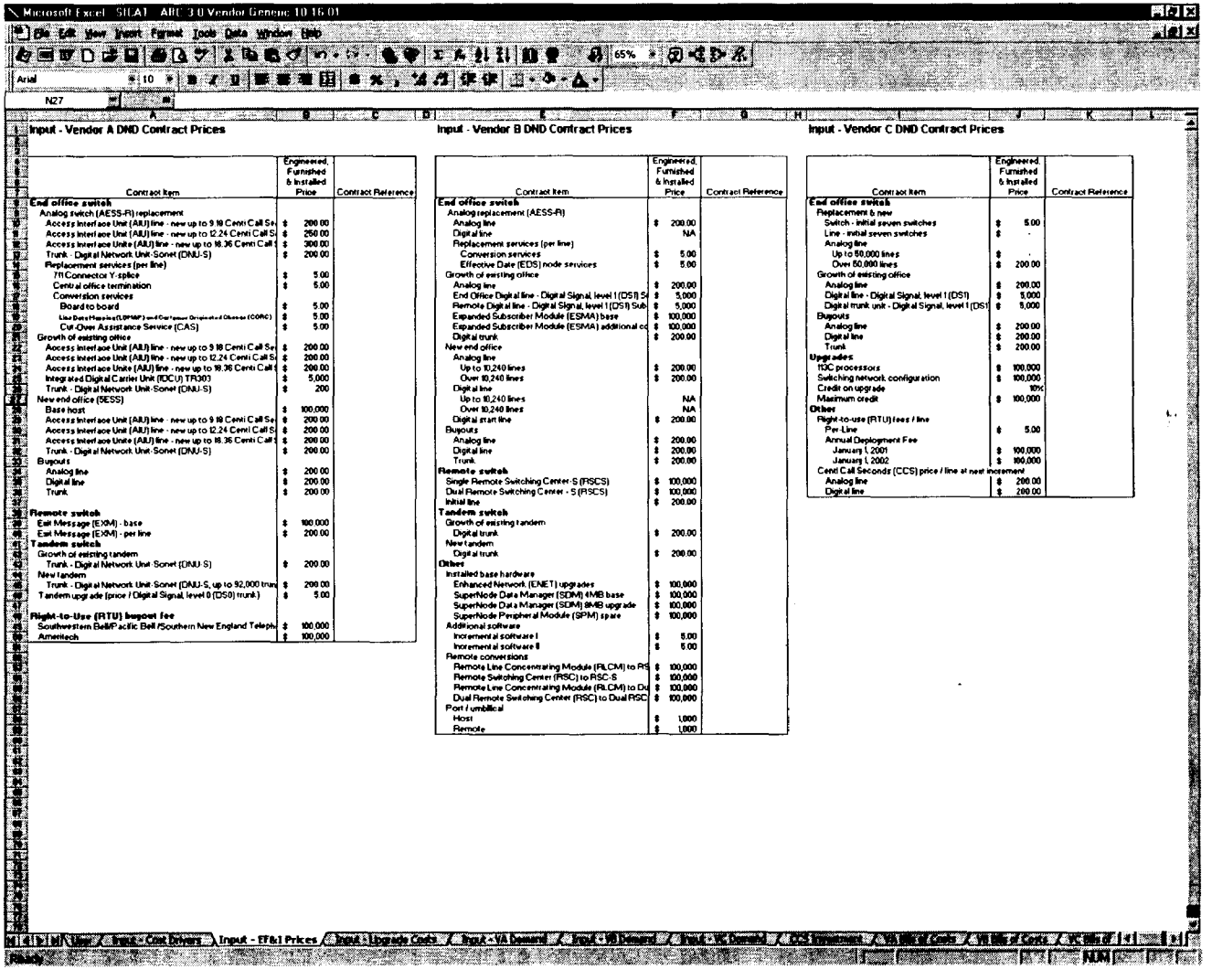
The *Input-EF&I Prices* spreadsheet contains prices for switch components from contracts between SBC and its switch vendors. It is important to note that SICAT models switch costs based on the price structure inherent in the vendor contracts. Changes in vendor contracts or contracts with new switch vendors alter the cost structure. When this occurs, it is necessary to modify the Input – EF&I prices and Bills of Costs spreadsheets, accordingly.

References to contract pages, exhibits or sections are provided for each price element. This allows prices to be verified against the contracts and provides a source for additional information on a price element. Appendix A lists the various contracts, letters, and amendments from which prices are drawn.

Figure 3.2 provides an example of the Input – EF&I Prices spreadsheet.

[8] See Section 2.1 for a description of switch usage and CCS as a measure of usage.
[9] An umbilical is the digital transmission facility interconnecting a host office to its remote switches.

Figure 3.2


Microsoft Excel - SICAT - AIEC 3.0 Vendor Generic 10 16 01
Input - Vendor A DND Contract Prices
Input - Vendor B DND Contract Prices
Input - Vendor C DND Contract Prices
Contract Item
Engineered, Furnished & Installed Price
Contract Reference
End office switch
Analog switch (AESS-FI) replacement
Access Interface Unit (AIU) line - new up to 9.18 Centi Call Se
Access Interface Unit (AIU) line - new up to 12.24 Centi Call S
Access Interface Units (AIU) line - new up to 18.36 Centi Call
Trunk - Digital Network Unit-Sonet (DNU-S)
Replacement services (per line)
711 Connector Y-splice
Central office termination
Conversion services
Board to board
Cut-Over Assistance Service (CAS)
Growth of existing office
Integrated Digital Carrier Unit (IDCU) TR303
New end office (SESS)
Base host
Bugouts
Analog line
Digital line
Trunk
Remote switch
Exit Message (EXM) - base
Exit Message (EXM) - per line
Tandem switch
Growth of existing tandem
New tandem
Tandem upgrade (price / Digital Signal, level 0 (DS0) trunk)
Right-to-Use (RTU) support fee
Ameritech
Analog replacement (AESS-FI)
Digital line
Replacement services (per line)
Conversion services
Effective Date (EDS) node services
Growth of existing office
Analog line
Digital trunk
New end office
Up to 10,240 lines
Over 10,240 lines
Digital start line
Remote switch
Single Remote Switching Center-S (RSCS)
Dual Remote Switching Center - S (RSCS)
Initial line
Tandem switch
Installed base hardware
Enhanced Network (ENET) upgrades
SuperNode Data Manager (SDM) 4MB base
SuperNode Data Manager (SDM) 8MB upgrade
SuperNode Peripheral Module (SPM) spare
Additional software
Incremental software I
Incremental software II
Remote conversions
Dual Remote Switching Center (RSC) to Dual RSC
Post / umbilical
Host
Remote
Switch - initial seven switches
Line - initial seven switches
Over 50,000 lines
Digital line - Digital Signal, level 1 (DS1)
Digital trunk unit - Digital Signal, level 1 (DS1)
Upgrades
I10C processors
Switching network configuration
Credit on upgrade
Maximum credit
Other
Right-to-use (RTU) fees / line
Per-Line
Annual Deployment Fee
January 1, 2001
January 1, 2002
Cent Call Seconds (CCS) price / line at next increment
Input - Cost Drivers
Input - EF&I Prices
Input - Upgrade Costs